

Comparing Fluoride Exposures in Pregnant Canadian Women: Fluoridated versus Nonfluoridated Drinking Water

Wendee Nicole

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Fluoridated water is piped to more than one-third of the Canadians¹ and nearly three-quarters of the Americans² who use public water systems. Although fluoride helps prevent dental cavities, some studies have suggested that higher prenatal exposures may affect neurodevelopment.^{3,4} Those findings make it important to understand exposure levels in general populations. Research published in *Environmental Health Perspectives* now sheds light on fluoride levels in pregnant women in Canada.⁵

As part of the Maternal–Infant Research on Environmental Chemicals (MIREC) Study, researchers measured urinary fluoride concentrations in 1,566 pregnant women from 10 Canadian cities. Seven of the cities add fluoride to public drinking water, while three don't.

After adjusting for urine dilution and potential confounders—including maternal age, pre-pregnancy body mass index, smoking status, water and tea consumption, education, and income—mean fluoride concentrations were found to be about twice as high in the urine of women living in cities with fluoridated water, compared with the urine of women in cities with nonfluoridated water. The study also found that, among all the mothers, average

fluoride concentrations increased between the first and third trimesters. The authors speculated that this increase may be due to increased fluoride uptake by the fetus earlier in pregnancy, when bone tissue is forming.

This study offers important insight into previous studies linking adverse neurodevelopmental outcomes to relatively high fluoride exposures. A 2012 meta-analysis of 27 studies conducted mostly in China reported an association between higher fluoride exposure and lower IQ scores in children.⁴ None of the studies reported water fluoride levels at or below the “optimal” concentration of 0.7 mg/L recommended by Health Canada⁶ and the U.S. Public Health Service.⁷ Concentrations in nearly half the studies were within the maximum contaminant level goal (MCLG) of 4 mg/L,⁸ which the U.S. Environmental Protection Agency (EPA) set as the maximum amount of fluoride allowed in drinking water. Far fewer levels were within the Canadian version of the MCLG, known as the maximum acceptable concentration, which is set at 1.5 mg/L.⁶

“It’s often stated that [the 2012 meta-analysis⁴] is not applicable to North America because the studies included were based on areas with endemic fluorosis, meaning that the drinking water in



In a 2010 exposure analysis, the U.S. EPA estimated that drinking water accounts for approximately 60% of American adults' fluoride intake; tea, coffee, and other beverages make up about 20%; foods account for about 13%; and the rest comes from other sources, including dental products.¹²

these studies had high concentrations of naturally occurring fluoride,” says Christine Till, an associate professor of psychology at York University and lead author of the present study. “According to the current MCLG, we would not be concerned with levels that are below 4 mg/L. [But] the EPA’s MCLG may be set too high.”

In 2017, a separate group of investigators also reported an inverse relationship between maternal urinary fluoride levels and child IQ in 211 mother–child pairs in Mexico City.⁹ The Mexico City cohort’s drinking water was not fluoridated, but it did contain naturally occurring fluoride; in addition, the women likely consumed fluoridated salt (a primary means by which the Mexican government distributes fluoride¹⁰). The mean urine fluoride levels in this cohort, after adjustment for dilution only, were similar for mothers and their children.

In the Mexico City study, higher maternal urinary fluoride concentrations were associated with lower IQ and cognitive scores. Notably, however, no association was found between test scores and the children’s own fluoride levels. In another study of these mothers and children, the same researchers reported that higher maternal urinary fluoride levels were associated with higher child scores on tests of ADHD symptoms.¹¹

The Till study is, so far, the largest study to characterize fluoride exposure among pregnant women, according to Morteza Bashash, a researcher at the Dalla Lana School of Public Health, University of Toronto, and first author of the Mexico City studies. Bashash says there were questions about whether his findings are applicable to women in Canada and the United States due to differences in the sources of fluoride. However, he points out that Till and colleagues reported⁵ adjusted mean levels in maternal urine samples that were very similar to levels found in Mexico.

Do the public health risks of community water fluoridation outweigh the benefits? “To answer this, we need to examine the current science and balance potential benefits and harms of *all* alternatives,” Till says. “The question is not whether fluoride is effective in preventing tooth decay, but rather whether there are safer ways for fluoride to work effectively, like applying fluoride topically.”

Till suggests that policy must consider risk estimates for susceptible populations who are particularly vulnerable to toxic environmental exposures. “After all,” she says, “with new knowledge, we reevaluated safe thresholds for lead, arsenic, organophosphate pesticides, and PCBs, so why not fluoride?”

Wendee Nicole has written for *Discover*, *Scientific American*, and other publications.

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